ARCADIS
Infrastructure · Water · Environment · Buildings

Imagine the result

Quarterly Operation, Maintenance, and Monitoring Report for the Bethpage Park Soil Gas Containment System

September 2014

Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York

NYSDEC ID # 1-30-003A

ARCADIS

Alba Bega
Staff Environmental Specialist

Paul Martorano, PE 088403
Project Engineer

Christopher Engler, PE 069748
Principal Engineer

Carlo San Giovanni
Project Manager

Quarterly Operation, Maintenance, and Monitoring Report for the Bethpage Park Soil Gas Containment System

September 2014

Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York
NYSDEC ID# 1-30-003A

Prepared for:
Northrop Grumman Systems Corporation

Prepared by:
ARCADIS of New York, Inc.
Two Huntington Quadrangle
Suite 1S10
Melville
New York 11747
Tel 631 249 7600
Fax 631 249 7610

Our Ref.:
NY001496.1214.OMMI4

Date:
November 12, 2014

ARCADIS

Table of Contents

Tables

Figures

Appendices

1. Introduction

Pursuant to the Administrative Order on Consent (AOC) Index # W1-0018-04-01 (NYSDEC 2005), ARCADIS of New York, Inc. (ARCADIS), on behalf of Northrop Grumman Systems Corporation (Northrop Grumman), has prepared this Operable Unit 3 (OU3) Bethpage Park Soil Gas Containment System (BPSGCS) Quarterly Operation, Maintenance, and Monitoring (OM&M) Report for submittal to the New York State Department of Environmental Conservation (NYSDEC). The present-day Bethpage Community Park property (Park), the Grumman Plant 24 Access Road, and McKay Field Access Road (which the NYSDEC has termed the "Former Grumman Settling Ponds Area" and designated as OU3) are referred to herein as the "Site Area". A Site Area location map is provided as Figure 1.

The BPSGCS (previously referred to as the Soil Gas Interim Remedial Measure [IRM]) has been operational since February 18, 2008. This quarterly OM&M report summarizes the BPSGCS activities conducted, data collected, system alarms documented, conclusions drawn, and recommendations made for the BPSGCS during the third quarter of 2014 (i.e., July 1 through September 30, 2014 [the "reporting period"]). During this reporting period, the BPSGCS OM&M was conducted in accordance with the NYSDEC-approved OU3 Soil Gas IRM OM&M Manual (ARCADIS 2009) and the NYSDEC-approved Sampling and Analysis Plan (SAP; ARCADIS 2008).

As discussed in the OU3 Site Area Remedial Investigation Report (Site Area RI Report; ARCADIS 2011), Northrop Grumman does not take responsibility for certain compounds (e.g., Freon 12 and Freon 22) present in the Site Area. Throughout this report, a distinction is made between the "Project" and "Non-project" volatile organic compounds (VOCs), which are defined as follows:

- Project VOCs: VOCs that may be related to former Northrop Grumman historical activities. For this report, Project VOCs include 1,1,1-trichloroethane; 1,1-dichloroethane; 1,2-dichloroethane; 1,1-dichloroethene; tetrachloroethene; trichloroethene; vinyl chloride; cis-1,2-dichloroethene; trans-1,2-dichloroethene; benzene; toluene; and total xylenes.

- Non-project VOCs: VOCs, such as Freon 12 and Freon 22, which are understood to be unrelated to former Northrop Grumman activities but have been detected in the Site Area. As noted in the Site Area RI Report (ARCADIS 2011), a groundwater sub-plume of Freon 22 has been identified originating from the area

of the Town of Oyster Bay's (Town's) former ice rink. Based on Town information (Zervos 2007), Freon 22 was used by the Town and released to the environment.

2. Bethpage Park Soil Gas Containment System Description and Objectives

Following review and approval of the Soil Gas IRM 95% Design Report and Design Drawings by the NYSDEC (ARCADIS 2007), the design package was finalized and the BPSGCS constructed. A general site plan (Figure 2) shows the treatment building, which houses the major process equipment, including two 20-horsepower [hp] and one 30 hp regenerative-type depressurization blowers, three 52-gallon moisture separators and associated transfer pumps, and one heat exchanger. Remaining system components are located outside the treatment building and include one 33-foot tall by 16-inch diameter stack, the 18 depressurization wells, and the 47 induced vacuum monitoring wells, also shown on Figure 2. Monitoring well vacuum measurements collected during this reporting period are also provided on Figure 2. A process flow diagram that shows sampling and monitoring locations is provided as Figure 3. A detailed description of the system and a complete set of record drawings are provided in the OM&M Manual (ARCADIS 2009).

The remedial action objectives of the BPSGCS are as follows:

- To mitigate the off-site migration of Project VOCs in the on-site soil gas through the implementation of a soil gas containment system installed along the Plant 24 Access Road and McKay Field Access Road, south and west of the Park, respectively

- To comply with applicable NYSDEC Standards, Criteria, and Guidelines (SCGs)

The compliance objectives of the BPSGCS are as follows:

- To mitigate the off-site migration of soil gas, the system was designed to maintain -0.1 inch of water column (iwc) within a negative pressure curtain established along the Plant 24 Access Road and McKay Field Access Road based on a 12-month rolling average.

- To collect and treat vapors until it is demonstrated that all VOCs in the influent (untreated) vapor stream are present at concentrations lower than the NYSDEC Division of Air Resources Guide-1 (DAR-1) Annual Guidance Concentrations (AGCs) on a 12-month rolling average and Short-Term Guidance Concentrations

(SGCs) for any given grab sample (NYSDEC 2014). On December 29, 2008, NYSDEC approved removal of vapor phase treatment (NYSDEC 2008).

- To collect and transfer condensate to the Nassau County Department of Public Works (NCDPW) sanitary sewer, in accordance with the requirements set forth by the NCDPW (NCDPW 2007, 2008) or dispose off site at a NYSDEC-permitted disposal facility. The sanitary sewer ultimately discharges to the Town of Oyster Bay's Cedar Creek treatment facility.

3. Operation and Maintenance Activities

The BPSGCS operated continuously during the reporting period (more than 99 percent uptime) with the exception of brief shutdown periods for alarm conditions and for routine and non-routine system maintenance. System shutdowns due to alarm conditions were as follows:

- Treatment Building 2 (TB-2) high temperature (July 5, 2014): The system shut down for approximately 1 hour due to a TB-2 high temperature alarm. The cause of the alarm was a failure of the building air conditioner. A new air conditioner unit was installed on August 14, 2014. While waiting for the air conditioner replacement unit, the TB-2 ventilation fan was used to maintain the treatment building temperature below 105 degrees Fahrenheit (°F).

- Blower BL-200 low vacuum (September 7, 2014): The system shut down for approximately 1 hour due to a failure of blower BL-200. The system was restarted with blower BL-300 in operation. Blower BL-200 was removed from the system on September 16, 2014 for further troubleshooting and maintenance, and was returned to operation on September 30, 2014. Blower BL-300 was removed from the system operation on September 30, 2014 for maintenance and is expected to be reinstalled and returned to operation during the fourth quarter.

Routine monthly O&M activities completed during the reporting period included: inspection of piping, appurtenances, and mechanical equipment for leaks, defects, or other problems; maintenance of equipment in accordance with the manufacturers' specifications; and adjustment of valves and equipment set points to maintain treatment system operating ranges for flow and vacuum. Non-routine O&M activities completed during the reporting period included replacement of the air conditioner unit and system blower maintenance and troubleshooting (BL-200 and BL-300).

4. Monitoring Activities and Results

The following subsections of this report summarize the monitoring activities and results of routine performance and compliance monitoring for the reporting period. The objectives of the performance monitoring program are to demonstrate that the system components are operating in accordance with the manufacturers' specifications and that the operating parameters are within acceptable operating ranges, as provided in Table 3 of the revised OM&M Manual. The purpose of the compliance monitoring program (consisting of the collection of compliance-related induced vacuum readings and effluent vapor/water samples) is to demonstrate that the system is meeting the compliance objectives described in Section 2 of this report.

4.1 Routine Performance Monitoring

The routine quarterly performance monitoring event was completed on September 10, 2014 (hereinafter referred to as the "September monitoring event"). A brief discussion of the monitoring results obtained is provided below.

4.1.1 System Operating Parameters

System operating parameters measured during the September monitoring event are summarized in Tables 1 and 2. Except for the blower influent vacuum and effluent pressure, system operating parameters were consistent with the recommended values in Table 3 of the revised OM&M Manual, which is being submitted under separate cover. During the reporting period, system components were operated in accordance with manufacturers' recommendations. The heat exchanger influent temperature remained lower than the design influent temperature (i.e., 150 °F); accordingly, the heat exchanger was not operated during the reporting period.

Although some system components operated outside of their recommended ranges, the instantaneous induced-vacuum readings at all compliance-related monitoring points was greater than or equal to -0.1 iwc, with the exception of VMWC-18A (see Section 4.2.1 of this report). Therefore, no immediate action is warranted. The system operating parameters described above will continue to be evaluated and addressed, if necessary, during the next reporting period. Additional recommendations are provided in Section 6.2 of this report.

4.1.2 Vapor Sample

The total effluent screening level vapor sample (i.e., photoionization detector [PID] reading) measured during the reporting period is provided in Table 1. The screening result was 0.0 parts per million by volume, which is consistent with historical data.

4.2 Routine Compliance Monitoring

Routine compliance monitoring was conducted during the September monitoring event. A brief discussion of the compliance monitoring results is provided below.

4.2.1 System Operating Parameters

Instantaneous vacuum measurements in compliance monitoring wells from the September monitoring event and annual time-weighted rolling averages are summarized in Table 2. September measurements are also shown (in text box format) on Figure 2.

As shown in Table 2, during the September monitoring event, the instantaneous induced vacuum at all compliance-related monitoring points was greater than or equal to -0.1 iwc, with the exception of VMWC-18A (-0.096 iwc). Although the September instantaneous induced vacuum measurements at VMWC-18A was slightly lower than -0.1 iwc, the annual time-weighted rolling average induced vacuum readings at all compliance-related monitoring points were maintained at greater than or equal to -0.1 iwc, demonstrating that the BPSGCS is operating as designed.

4.2.2 Vapor Sample

A total effluent vapor sample was collected on September 10, 2014. As shown in the laboratory results in Table 3 and Appendix A-1, the total volatile organic compound (TVOC) concentration of 720 micrograms per cubic meter ($\mu g/m^3$) was lower than the June 2014 concentration (1,113 $\mu g/m^3$) but consistent with historical data. The Project TVOC concentration of 542 $\mu g/m^3$ and the Non-project TVOC concentration of 178 $\mu g/m^3$ were also lower than the June 2014 concentrations (832 and 281 $\mu g/m^3$, respectively), but consistent with historical data.

Benzene was the only environmentally “A”-rated compound (as defined in DAR-1 AGC/SGC tables, revised February 28, 2014) detected in the effluent vapor sample

during the September monitoring event; the concentration was consistent with historical data.

Seventeen tentatively identified compounds (TICs) were also identified by the laboratory (Appendix A-2). The concentrations of the TICs were consistent with historical data.

4.2.3 Condensate Samples

A compliance monitoring condensate sample was not required to be collected for laboratory analysis during the reporting period.

5. Air Emissions Model

Effluent vapor laboratory results were compared to the NYSDEC DAR-1 SGCs (Table 3). In addition, effluent vapor laboratory analytical results were compared to a site-specific modeled annual maximum allowable stack concentration (MASC). The annual MASC was calculated during each monitoring event for individual compounds using the output from a U.S. Environmental Protection Agency (USEPA) SCREEN3 model in conjunction with the NYSDEC DAR-1 AGCs. A scaling factor was calculated using the SCREEN3 model with site-specific physical layout (e.g., building dimension, stack height, terrain) and operating data (e.g., discharge flow rate, temperature) inputs for each monitoring event. The scaling factor was then used to adjust (scale) the NYSDEC DAR-1 AGC to a site-specific annual MASC. A summary of the instantaneous percent (i.e., not time-weighted) of the site-specific annual MASC for detected compounds is provided in Table 4. A summary of the cumulative annual percent (i.e., time-weighted) of the site-specific MASC for detected compounds is also provided in Table 4. A summary of the model input, outputs, and backup calculations is provided in Appendix B.

The BPSGCS effluent vapor met applicable air discharge criteria based on the following:

- The measured concentrations of individual VOCs in the effluent did not exceed applicable SGCs (Table 3).
- The measured concentrations of individual VOCs in the effluent did not exceed applicable instantaneous MASCs, as calculated using the USEPA SCREEN 3

Model (Table 4). Similarly, the time-weighted rolling average for all detected compounds is well below the MASCs.

- One environmentally "A"-rated compound was detected in the effluent vapor during the reporting period. Specifically, benzene was detected at 2.7 µg/m^3. However, the mass emission rate for benzene was 7.2 x 10^{-6} pounds per hour (lbs/hr), which is well below the NYSDEC recommended action level of 0.01 lbs/hr. Therefore, no treatment is required.

6. Conclusions and Recommendations

6.1 Conclusions

- The BPSGCS operated continuously during the reporting period with the exception of brief shutdown periods for routine and non-routine maintenance and alarm conditions.

- System operating parameters were consistent with the recommended values in the OM&M Manual, and system components were operated in accordance with manufacturers' recommendations.

- The September 2014 compliance monitoring results indicate that the system continues to operate as designed. Specifically, BPSGCS maintained -0.1 iwc or greater within all induced vacuum monitoring points based on a 12-month rolling average (from September 5, 2013 through September 10, 2014).

- Vapor emissions met applicable guidance and regulatory criteria.

6.2 Recommendations

Based on the information provided herein, ARCADIS makes the following recommendations for the October to December 2014 operating period:

- Continue operation of the BPSGCS.

- Due to the low instantaneous vacuum measured in VMWC-18A, continue to closely monitor the induced vacuum at this depressurization well and, if necessary, remove accumulated condensate from the subsurface depressurization well pipeline.

- Reinstall Blower BL-300 following blower maintenance.

- Based on the consistent operation of the BPSGCS since February 2008, we continue to recommend that the current, quarterly reporting frequency be reduced to annual. Consistent with the NYSDEC-approved OU3 Soil Gas IRM OM&M Manual (ARCADIS 2009), an annual report will be prepared to summarize system operation, performance, and monitoring data. The annual report will be prepared and submitted under the supervision of a licensed, professional engineer in the State of New York. Additionally, pertinent data collected for the BPSGCS will be submitted to the NYSDEC as part of the semi-annual progress reports currently completed in accordance with Section III of AOC Index #W1-0018-04-01. Upon receipt of NYSDEC approval of this recommendation, the OU3 BPSGCS OM&M Manual will be updated to reflect this change.

7. References

ARCADIS of New York, Inc. 2007. 95% Design Report, Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A, September 7, 2007.

ARCADIS of New York, Inc. 2008. 95% Design Report, Appendix C, Sampling and Analysis Plan, Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A, February 8, 2008.

ARCADIS of New York, Inc. 2009. Operable Unit 3, Operation, Maintenance, and Monitoring Manual, Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A, January 23, 2009.

ARCADIS of New York, Inc. 2011. Remedial Investigation Report (Site Area). Operable Unit 3 – Former Grumman Settling Ponds, Bethpage, New York. Site #1-30-003A. February 8, 2011.

County of Nassau Department of Public Works (NCDPW). 2007. Letter Regarding Discharge of IRM Condensate Water, Northrop Grumman, OU3 Site, Bethpage, New York. October 16, 2007.

NCDPW. 2008. Letter Regarding Discharge of IRM Condensate Water Northrop, Grumman, OU3 Site, Bethpage, New York. September 17, 2008.

New York State Department of Environmental Conservation (NYSDEC). 2005. Order on Consent Index #WI-0018-04-01, Site # 1-30-003A, July 4, 2005.

NYSDEC. 2007. Approval Letter of 95 Percent Design, Former Grumman Settling Ponds, NYSDEC Nassau County Site No. 1-30-003A OU3 (Bethpage Community Park), September 19, 2007.

NYSDEC. 2008. Letter of Approval For Proposed Modifications, December 12, 2008.

NYSDEC. 2014. Division of Air Resources (DAR-1) Guidelines for the Control of Toxic Ambient Air Contaminants dated 1991 and the AGC/SGC Tables dated February 28, 2014.

Zervos, Theodore. 2007. Deposition of Theodore Zervos in the matter Town of Oyster Bay v. Northrop Grumman Systems Corporation et al. Case No. 05-CV-1945 (TCP)(AKT). January 22, 2007.

ARCADIS

Tables

ARCADIS

Table 1. Summary of General System Operating Parameters, Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System, Former Grumman Settling Ponds, Bethpage, New York.

	DW-7S Parameters			DW-7D Parameters			DW-3S Parameters			DW-3D Parameters			DW-5S Parameters			DW-5D Parameters			DW-6S Parameters			DW-6D Parameters		
	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum
Date	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc
12/04/13	100	-19	-1.7	5.0	-11	-0.46	5.0	-6.5	-0.22	10	-9.0	-0.39	85	-19	-1.4	12	-13	-2.3	75	-18	-1.8	7.2	-5.5	-1.5
03/11/14	93	-15	-1.7	4.0	-20	-0.38	12	-9.1	-0.40	11	-6.4	-0.44	62	-12	-1.1	11	-12	-2.7	84	-16	-1.8	6.9	-5.4	-1.6
06/20/14	110	-18	-1.6	12	-12	-0.52	7.0	-4.8	-0.23	17	-8.2	-0.48	103	-16	-1.5	13	-14	-2.3	85	-15	-1.4	8.3	-6.2	-1.5
09/10/14	97	-20	-1.7	6.8	-8.2	-0.42	7.0	-5.2	-0.20	11	-7.0	-0.30	84	-15	-1.4	15	-8.5	-2.0	82	-17	-1.6	5.9	-5.4	-1.1

Notes and Abbreviations

°F	degrees Fahrenheit
DW	depressurization well
gal	gallons
Hz	Hertz
iwc	inches of water column
--	not applicable
PID	photoionization detector
ppmv	parts per million by volume
scfm	standard cubic feet per minute

1	Total gallons of water accumulated at storage tank ST-510 per quarter.
2	Total effluent air velocity in feet per minute was measured using a hand-held anemometer at the stack effluent location. The total effluent flow rate in scfm was calculated by multiplying the measured air velocity by the pipe area, the ratio of the standard air temperature to the measured air temperature, and the ratio of the measured air pressure to the standard air pressure.
3	Value was measured on January 27, 2014 due to an erroneous value recorded on December 4, 2013 as a result of a faulty pressure gauge.
4	Value was remeasured on December 6, 2013 due to an erroneous value of the total effluent flow rate recorded on December 4, 2013.
5	Value was remeasured on April 9, 2014 due to an erroneous value recorded on March 11, 2014 as a result of a faulty pressure gauge.
6	Value was remeasured on June 30, 2014 due to an erroneous value recorded on June 20, 2014 as a result of a faulty pressure gauge.

ARCADIS

Table 1. Summary of General System Operating Parameters, Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System, Former Grumman Settling Ponds, Bethpage, New York.

	DW-1S Parameters			DW-1D Parameters			DW-4S Parameters			DW-4D Parameters			DW-8S Parameters			DW-9S Parameters			DW-2S Parameters			DW-2D Parameters		
	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum
Date	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc
12/04/13	80	-23	-2.0	3.2	-2.2	-1.0	70	-16	-1.5	4.0	-5.8	-0.63	47	-17	-1.4	33	-14	-1.3	29	-24	-1.4	21	-14	-1.3
03/11/14	66	-17	-1.6	3.1	-2.0	-0.91	63	-13	-1.3	8.5	-9.1	-0.78	65	-17	-1.9	38	-14	-1.7	27	-23	-1.4	18	-12	-1.4
06/20/14	75	-18	-1.4	8.3	-4.7	-2.0	85	-14	-1.6	5.5	-11	-0.73	68	-17	-1.7	37	-14	-1.2	27	-18	-1.3	32	-21	-2.0
09/10/14	72	-19	-1.5	4.7	-2.8	-1.2	62	-14	-1.2	5.5	-5.6	-0.51	60	-18	-1.8	28	-13	-1.1	28	-22	-1.5	29	-19	-2.0

Notes and Abbreviations

°F	degrees Fahrenheit
DW	depressurization well
gal	gallons
Hz	Hertz
iwc	inches of water column
--	not applicable
PID	photoionization detector
ppmv	parts per million by volume
scfm	standard cubic feet per minute

1	Total gallons of water accumulated at storage tank ST-510 per quarter.
2	Total effluent air velocity in feet per minute was measured using a hand-held anemometer at the stack effluent location. The total effluent flow rate in scfm was calculated by multiplying the measured air velocity by the pipe area, the ratio of the standard air temperature to the measured air temperature, and the ratio of the measured air pressure to the standard air pressure.
3	Value was measured on January 27, 2014 due to an erroneous value recorded on December 4, 2013 as a result of a faulty pressure gauge.
4	Value was remeasured on December 6, 2013 due to an erroneous value of the total effluent flow rate recorded on December 4, 2013.
5	Value was remeasured on April 9, 2014 due to an erroneous value recorded on March 11, 2014 as a result of a faulty pressure gauge.
6	Value was remeasured on June 30, 2014 due to an erroneous value recorded on June 20, 2014 as a result of a faulty pressure gauge.

Table 1. Summary of General System Operating Parameters, Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System, Former Grumman Settling Ponds, Bethpage, New York.

	DW-10S Parameters			DW-11S Parameters			Knock Out Tank Parameters - Vacuum			Condensate Water Collected[1]	Blower Parameters BL-200			Blower Parameters BL-300			Blower Parameters BL-400			Combined Effluent Parameters				
	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Influent KO-200	Influent KO-300	Influent KO-400	Influent ST-510	Influent Vacuum	Effluent Pressure	Blower Speed	Influent Vacuum	Effluent Pressure	Blower Speed	Influent Vacuum	Effluent Pressure	Blower Speed	Total Effluent Flow Rate[2]	Total Effluent PID	Heat Exchanger Influent Temp.	Total Effluent Pressure	Heat Exchanger Effluent Temp.
Date	scfm	iwc	iwc	scfm	iwc	iwc	iwc	iwc	iwc	Gallons	iwc	iwc	Hz	iwc	iwc	Hz	iwc	iwc	Hz	scfm	ppmv	°F	iwc	°F
12/04/13	30	-14	-1.6	29	-22	-2.6	-40	--	--	0	-45	2.2[3]	--	--	--	--	--	--	--	720[4]	0.0	100[4]	2.0	100
03/11/14	40	-13	-2.2	39	-22	-3.0	-39	--	--	90	-42	2.6[5]	55.53	--	--	--	--	--	--	666	0.0	105	3.0	94
06/20/14	35	-13	-2.0	29	-18	-2.1	-27	--	--	0	-31	2.6[6]	59.48	--	--	--	--	--	--	734	0.0	110	2.5	104
09/10/14	27	-13	-1.5	31	-22	-2.2	--	-26	--	0	--	--	--	-29	3.8	60.00	--	--	--	683	0.0	110	3.0	96

Notes and Abbreviations

°F	degrees Fahrenheit
DW	depressurization well
gal	gallons
Hz	Hertz
iwc	inches of water column
--	not applicable
PID	photoionization detector
ppmv	parts per million by volume
scfm	standard cubic feet per minute

1 Total gallons of water accumulated at storage tank ST-510 per quarter.

2 Total effluent air velocity in feet per minute was measured using a hand-held anemometer at the stack effluent location. The total effluent flow rate in scfm was calculated by multiplying the measured air velocity by the pipe area, the ratio of the standard air temperature to the measured air temperature, and the ratio of the measured air pressure to the standard air pressure.

3 Value was measured on January 27, 2014 due to an erroneous value recorded on December 4, 2013 as a result of a faulty pressure gauge.

4 Value was remeasured on December 6, 2013 due to an erroneous value of the total effluent flow rate recorded on December 4, 2013.

5 Value was remeasured on April 9, 2014 due to an erroneous value recorded on March 11, 2014 as a result of a faulty pressure gauge.

6 Value was remeasured on June 30, 2014 due to an erroneous value recorded on June 20, 2014 as a result of a faulty pressure gauge.

ARCADIS

Table 2. Summary of Induced Vacuum Readings at Compliance Monitoring Points, Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System, Former Grumman Settling Ponds, Bethpage, New York. [1][2]

Well ID:	DW-7S		DW-7D	DW-3S	DW-3D	DW-5S		DW-5D	DW-1S			DW-1D	DW-4D	DW-8S		DW-2S		DW-2D		DW-11S	
MP ID:	VMWC-14A	VMWC-14B	VMWC-14D	VMWC-11B	VMWC-12D	VMWC-15A	VMWC-15B	VMWC-15D	VMWC-3A	VMWC-3B	VMWC-3C	VMWC-3D	VMWC-16D	VMWC-16A	VMWC-16B	VMWC-7A	VMWC-7B	VMWC-13D	VMWC-17D	VMWC-18A	VMWC-18B
Date	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc
12/04/13	-0.12	-0.19	-0.19	-0.16	-0.15	-0.14	-0.14	-0.15	-0.13	-0.13	-0.14	-0.20	-0.20	-0.14	-0.14	-0.093	-0.098	-0.22[5]	-0.15	-0.10	-0.10
03/11/14	-0.11	-0.19	-0.16	-0.14	-0.15	-0.14	-0.12	-0.12	-0.13	-0.13	-0.13	-0.20	-0.13	-0.18[6]	-0.18[6]	-0.10	-0.12	-0.12[7]	-0.19[7]	-0.13	-0.15
06/20/14	-0.10	-0.18	-0.19	-0.10	-0.14	-0.14	-0.13	-0.16	-0.11	-0.12	-0.12	-0.19	-0.16	-0.15	-0.16	-0.13	-0.11	-0.13	-0.18	-0.093	-0.11
09/10/14	-0.10	-0.16	-0.16	-0.11	-0.11	-0.13	-0.14	-0.15	-0.11	-0.11	-0.11	-0.14	-0.19	-0.14	-0.16	-0.11	-0.11	-0.11	-0.26	-0.096	-0.12
Time Weighted Rolling Average[3]	-0.11	-0.18	-0.18	-0.13	-0.14	-0.14	-0.13	-0.14	-0.12	-0.12	-0.13	-0.18	-0.17	-0.15	-0.16	-0.11	-0.11	-0.14	-0.19	-0.11	-0.12

Gross Average Compliance Points [4]	
09/10/14	-0.13

Notes and Abbreviations:

DW	depressurization well
VMWC	vapor monitoring well cluster
iwc	inches of water column

1 All induced vacuum measurements units in iwc. Values shown have been rounded to two significant figures.

2 Compliance goal is -0.1 iwc of vacuum at all compliance monitoring points, based on a twelve-month rolling average.

3 Time weighted rolling average calculated by summing the products of the instantaneous induced vacuum readings and the number of days between readings for a 12-month monitoring period, and dividing by the total time period between the first and last quarterly induced vacuum readings.

4 Gross average compliance points calculated by summing the induced vacuum values for the noted monitoring event and dividing by the number of readings.

5 Value was remeasured on December 16, 2013 due to an erroneous value recorded on December 4, 2013.

6 Value was measured on March 21, 2014 due to well inaccessibility on March 11, 2014.

7 Value was remeasured on March 21, 2014 due to an erroneous value recorded on March 11, 2014.

Table 3. Summary of Total Effluent Vapor Sample Analytical Results, Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System, Former Grumman Settling Ponds, Bethpage, New York.[1]

Compound[2] (units in µg/m^3)		Sample ID:	VSP-601	VSP-601	VSP-601	VSP-601
		Sample Date:	12/4/2013	3/11/2014	6/20/2014	9/10/2014
Project VOCs	CAS No.	SGC				
1,1,1-Trichloroethane	71-55-6	9,000	**13**	**7.6**	**7.3**	**6.3**
1,1-Dichloroethane	75-34-3	NS	**11**	**6.9**	**6.2**	**5.4**
1,1-Dichloroethene	75-35-4	380[4]	**1.6**	< 2.0	**1.4**	**0.77**
Benzene	71-43-2	1,300	< 0.91	**18**	< 0.70	**2.7**
cis-1,2-Dichloroethene	156-59-2	190,000[5]	**500 D**	**320**	**410 D**	**190 D**
Tetrachloroethene	127-18-4	300	**14**	**7.9**	**13**	**14**
Toluene	108-88-3	37,000	< 0.91	< 2.0	**0.75**	< 0.77
trans-1,2-Dichloroethene	156-60-5	190,000[5]	**3.3**	< 2.0	**2.5**	**2.5**
Trichloroethylene	79-01-6	14,000	**570 D**	**300**	**390 D**	**320 D**
Vinyl chloride	75-01-4	180,000	**0.92**	< 2.0	**0.99**	< 0.77
Subtotal Project VOCs			**1,114**	**660**	**832**	**542**
Non-Project VOCs						
2-Hexanone	591-78-6	4,000	< 0.91	< 2.0	< 0.70	**0.86**
1-Chloro-1,1-difluoroethane (Freon 142b)	75-68-3	NS	**170**	**150**	**260 D**	**150**
Acetone	67-64-1	180,000	< 9.1	< 20	**7.1**	**15**
Chlorodifluoromethane (Freon 22)	75-45-6	NS	**3.0**	**2.8**	**1.2**	**1.1**
Chloroform	67-66-3	150	**38**	**8.0**	**9.8**	**7.7**
Dichlorodifluoromethane (Freon 12)	75-71-8	NS	**2.5**	**2.2**	**2.1**	**2.1**
Trichlorofluoromethane (Freon 11)	75-69-4	9,000	**1.3**	< 2.0	**1.2**	**1.6**
Subtotal Non-Project VOCs			**215**	**163**	**281**	**178**
TVOC[3]			**1,329**	**823**	**1,113**	**720**

Notes and abbreviations on last page.

Table 3. Summary of Total Effluent Vapor Sample Analytical Results, Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System, Former Grumman Settling Ponds, Bethpage, New York.[(1)]

Notes and Abbreviations:

Bold	Bold data indicates that the analyte was detected at or above its reporting limit.
D	Compound detected at a secondary dilution.
NS	Guideline concentrations not specified in the NYSDEC DAR-1 AGC/SGC tables, revised February 28, 2014. An interim SGC was not developed for these compounds because they have low toxicity ratings, as specified in the NYSDEC DAR-1 AGC/SGC tables, revised February 28, 2014.
CAS No.	Chemical Abstracts Service list number
DAR-1	Division of Air Resources-1 Air Guide-1
NYSDEC	New York State Department of Environmental Conservation
AGC	Allowable Annual Guideline Concentration
SGC	Short-term Guideline Concentrations
TVOC	total volatile organic compounds
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
µg/m^3	micrograms per cubic meter
<	Compound not detected above its laboratory quantification limit.

1. Samples were collected by operation and maintenance personnel on the dates shown and submitted to ALS Environmental, Simi Valley, CA for volatile organic compound analyses using USEPA Method TO-15 modified in accordance with the project Sampling and Analysis Plan (ARCADIS 2008). Data presented in this table correspond to the past year of system operation.
2. Table summarizes detected compounds only.
3. TVOC determined by summing individual detections and rounding to the nearest whole number.
4. An SGC was not provided in the DAR-1 AGC/SGC Tables, revised February 28, 2014. An interim SGC was developed based on guidance provided in Section IV.A.2.b.1 of the New York State DAR-1 Guidelines for the Control of Toxic Ambient Air Contaminants, 1991 edition. Specifically for 1,1- dichloroethene, which is not defined as a high-toxicity compound, the Interim SGC = (smaller of Time Weighted Average [TWA] - Threshold Limit Value or TWA - Recommended Exposure Limit)/4.2. or 1,600 µg/m^3 / 4.2 = approximately 380 µg/m^3. An interim SGC was developed for this compound because it has a moderate toxicity rating, as specified in the DAR-1 AGC/SGC Tables, revised February 28, 2014.
5. An SGC was not provided in the DAR-1 AGC/SGC Tables, revised February 28, 2014. An interim SGC was developed based on guidance provided in Section IV.A.2.b.1 of the New York State DAR-1 Guidelines for the Control of Toxic Ambient Air Contaminants, 1991 edition. Specifically for cis-1,2 dichloroethene and trans-1,2 dichloroethene, which are not defined as a high-toxicity compounds, the interim SGC = (smaller of Time Weighted Average [TWA] - Threshold Limit Value or TWA - Recommended Exposure Limit)/4.2 or 790,000 µg/m^3 / 4.2 = approximately 190,000 µg/m^3. An interim SGC was developed for these compounds because they have moderate toxicity ratings, as specified in the DAR-1 AGC/SGC Tables, revised February 28, 2014.

Table 4. Summary of Air Emissions Model Output, Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System, Former Grumman Settling Ponds, Bethpage, New York.

Compound[1]	AGC[2] ($\mu g/m^3$)	Percent of MASC Per Event[3]				Cumulative % MASC[4]
		12/4/2013	3/11/2014	6/20/2014	9/10/2014	
1,1,1-Trichloroethane	5,000	0.0%	0.0%	0.0%	0.0%	0.0%
1,1-Dichloroethane	0.63	0.052%	0.032%	0.034%	0.029%	0.037%
1,1-Dichloroethene	200	0.0%	0.0%	0.0%	0.0%	0.0%
1-Chloro-1,1-difluoroethane (Freon 142b)	50,000	0.0%	0.0%	0.0%	0.0%	0.0%
2-Hexanone	30	0.0%	0.0%	0.0%	0.0%	0.0%
Acetone	30,000	0.0%	0.0%	0.0%	0.0%	0.0%
Benzene	0.13	0.0%	0.40%	0.0%	0.070%	0.12%
Chlorodifluoromethane (Freon 22)	50,000	0.0%	0.0%	0.0%	0.0%	0.0%
Chloroform	14.7	0.0077%	0.0016%	0.0023%	0.0018%	0.0033%
cis-1,2-Dichloroethene	63	0.024%	0.015%	0.023%	0.010%	0.018%
Dichlorodifluoromethane (Freon 12)	12,000	0.0%	0.0%	0.0%	0.0%	0.0%
Tetrachloroethene	4.0	0.010%	0.006%	0.011%	0.012%	0.010%
Toluene	5,000	0.0%	0.0%	0.0%	0.0%	0.0%
trans-1,2-Dichloroethene	63	0.0%	0.0%	0.0%	0.0%	0.0%
Trichloroethylene	0.2	8.5%	4.3%	6.8%	5.4%	6.3%
Trichlorofluoromethane (Freon 11)	5,000	0.0%	0.0%	0.0%	0.0%	0.0%
Vinyl chloride	0.068	0.040%	0.0%	0.051%	0.0%	0.024%

Notes and abbreviations on last page.

Table 4. Summary of Air Emissions Model Output, Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System, Former Grumman Settling Ponds, Bethpage, New York.

Notes and Abbreviations:

AGC	Allowable Annual Guideline Concentration
DAR-1	Division of Air Resources Air Guide-1
MASC	Maximum Allowable Stack Concentration
µg/m^3	micrograms per cubic meter
NYSDEC	New York State Department of Environmental Conservation
SGC	Short-term Guideline Concentration
USEPA	U.S. Environmental Protection Agency
%	percent

1. Table summarizes detected compounds only.
2. AGC refers to the compound-specific AGC per the NYSDEC DAR-1 AGC/SGC tables, revised February 28, 2014. NYSDEC DAR-1 AGCs were scaled using the results of a site-specific USEPA SCREEN 3 model to calculate the annual MASC per monitoring event.
3. Percent of MASC per event was calculated by dividing the actual effluent concentration by the site-specific annual MASC. Detailed calculations are included in Appendix B.
4. Cumulative percent of the MASC was calculated using a time-weighted average of the percent MASC per event. Values shown have been rounded to include two significant figures.

`

ARCADIS

Figures

SOURCE:
USGS 7.5 MIN. AMITYVILLE QUADRANGLE, AMITYVILLE, N.Y., 1994, FREEPORT QUADRANGLE, FREEPORT, N.Y., 1994,
HICKSVILLE QUADRANGLE, HICKSVILLE, N.Y., 1967, PHOTOREVISED 1979, HUNTINGTON, N.Y., 1967, PHOTOREVISED 1979

0 2000' 4000'

SCALE IN FEET

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK

OPERABLE UNIT 3
FORMER GRUMMAN SETTLING PONDS

SITE AREA LOCATION MAP
BETHPAGE PARK SOIL GAS CONTAINMENT SYSTEM

ARCADIS

FIGURE
1

CITY:SYRACUSE-NY DIV/GROUP:ENV DB:A.SANCHEZ LD: PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACTIVE\60014961212\SGS\4\NY1496 F01.dwg LAYOUT: BETHPAGE PARK SAVED: 4/10/2014 11:24 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 4/10/2014 11:39 AM BY: SANCHEZ, ADRIAN
XREFS: IMAGES: PROJECTNAME: ----
AMITYVILLE.TIF
FREEPORT.TIF
HICKSVILLE.TIF
HUNTINGTON.TIF

PROPERTY OWNED BY TOWN OF OYSTER BAY

STACK LOCATION

GRASS

TREATMENT BUILDING AREA

McKAY FIELD ACCESS ROAD

PLANT 24 ACCESS ROAD

GRASS

EIGHTH ST.

SEVENTH ST.

SIXTH ST.

FIFTH ST.

TH ST.

VMWC-14A	
Date	IV (IWC)
9/10/2014	−0.10

VMWC-14B	
Date	IV (IWC)
9/10/2014	−0.16

VMWC-14D	
Date	IV (IWC)
9/10/2014	−0.16

VMWC-11B	
Date	IV (IWC)
9/10/2014	−0.11

VMWC-12D	
Date	IV (IWC)
9/10/2014	−0.11

VMWC-3A	
Date	IV (IWC)
9/10/2014	−0.11

VMWC-3B	
Date	IV (IWC)
9/10/2014	−0.11

VMWC-3C	
Date	IV (IWC)
9/10/2014	−0.11

VMWC-3D	
Date	IV (IWC)
9/10/2014	−0.14

VMWC-15D	
Date	IV (IWC)
9/10/2014	−0.15

VMWC-15B	
Date	IV (IWC)
9/10/2014	−0.14

VMWC-15A	
Date	IV (IWC)
9/10/2014	−0.13

VMWC-16D	
Date	IV (IWC)
9/10/2014	−0.19

VMWC-16B	
Date	IV (IWC)
9/10/2014	−0.16

VMWC-16A	
Date	IV (IWC)
9/10/2014	−0.14

VMWC-17D	
Date	IV (IWC)
9/10/2014	−0.26

VMWC-7A	
Date	IV (IWC)
9/10/2014	−0.11

VMWC-7B	
Date	IV (IWC)
9/10/2014	−0.11

VMWC-13D	
Date	IV (IWC)
9/10/2014	−0.11

VMWC-18B	
Date	IV (IWC)
9/10/2014	−0.12

VMWC-18A	
Date	IV (IWC)
9/10/2014	−0.096

LEGEND:

- PROPERTY LINE NORTHROP GRUMMAN
- 6' CHAIN LINK FENCE
- VAPOR RECOVERY LINES
- VMWC-9A — NON-COMPLIANCE-RELATED VACUUM MONITORING WELL CLUSTER
- VMWC-14A — COMPLIANCE-RELATED VACUUM MONITORING WELL CLUSTER
- DW-3S — SHALLOW DEPRESSURIZATION WELL
- DW-3D — DEEP DEPRESSURIZATION WELL
- IV — INDUCED VACUUM MEASUREMENT
- (IWC) — INCHES OF WATER COLUMN
- USEPA — UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

0 50' 100'
SCALE IN FEET

NOTE:

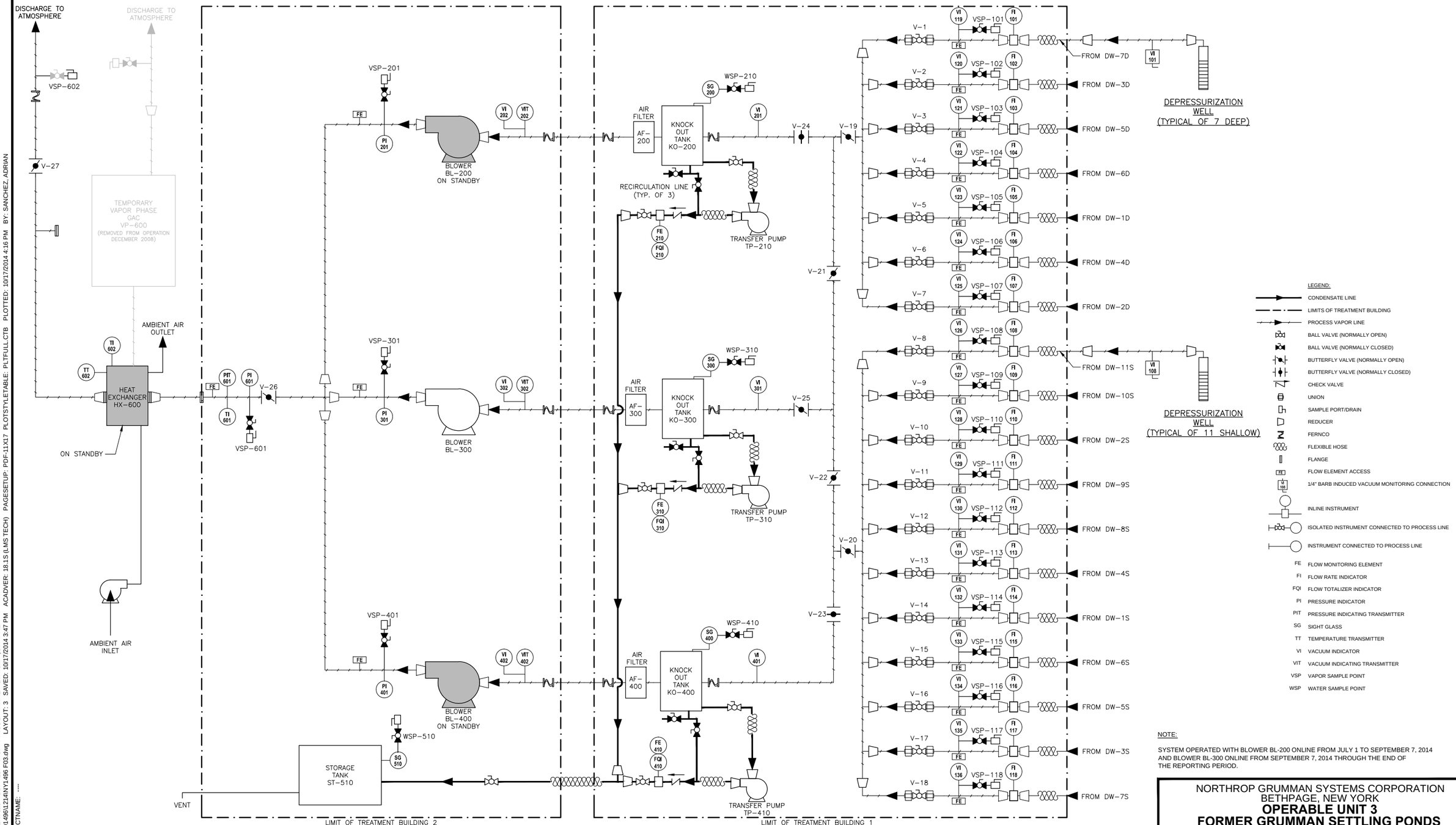
1. USEPA'S RADON GUIDANCE RECOMMENDS NEGATIVE PRESSURE OF 0.035 INCHES OF WATER FOR THE CONTROL OF SOIL VAPOR (EPA 625/R-93-011, 1993).
2. SYSTEM DESIGN OBJECTIVE IS TO MAINTAIN -0.1 IWC OF INDUCED VACUUM AT ALL COMPLIANCE-RELATED VACUUM MONITORING WELLS ON A 12-MOUNTH ROLLING AVERAGE (ARCADIS 2007).
3. DATA SHOWN HEREIN ARE COLLECTED FROM COMPLIANCE-RELATED VACUUM MONITORING WELLS ONLY.

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 3
FORMER GRUMMAN SETTLING PONDS

GENERAL SITE PLAN AND MONITORING WELL VACUUM MEASUREMENTS BETHPAGE PARK SOIL GAS CONTAINMENT SYSTEM

ARCADIS

FIGURE
2



NOTE:

SYSTEM OPERATED WITH BLOWER BL-200 ONLINE FROM JULY 1 TO SEPTEMBER 7, 2014 AND BLOWER BL-300 ONLINE FROM SEPTEMBER 7, 2014 THROUGH THE END OF THE REPORTING PERIOD.

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 3
FORMER GRUMMAN SETTLING PONDS

PROCESS FLOW DIAGRAM BETHPAGE PARK SOIL GAS CONTAINMENT SYSTEM

ARCADIS

FIGURE 3

CITY:MELVILLE-NY DIVGROUP:ENVcad DB: LD: PIC: PM:CSG TM:KZ LYR:ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACTINY\00149601214\NY1496 F03.dwg LAYOUT: 3 SAVED: 10/17/2014 3:47 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: PDF-11X17 PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 10/17/2014 4:16 PM BY: SANCHEZ, ADRIAN
XREFS: IMAGES: PROJECTNAME: ----

ARCADIS

Appendix A

Vapor Sample Analytical Results Including Tentatively Identified Compounds

Appendix A-1. Total Effluent Vapor Sample Analytical Results, Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System, Former Grumman Settling Ponds, Bethpage, New York. [1]

Compound (units in µg/m^3)	CAS No.	Sample ID: VSP-601 Sample Date: 9/10/2014
1,1,1-Trichloroethane	71-55-6	**6.3**
1,1,2,2-Tetrachloroethane	79-34-5	< 0.77
1,1,2-Trichloroethane	79-00-5	< 0.77
1,1-Dichloroethane	75-34-3	**5.4**
1,1-Dichloroethene	75-35-4	**0.77**
1,2-Dichloroethane	107-06-2	< 0.77
1,2-Dichloropropane	78-87-5	< 0.77
1,3-Butadiene	106-99-0	< 0.77
1-Chloro-1,1-difluoroethane (Freon 142b)	75-68-3	**150**
2-Butanone	78-93-3	< 7.7
2-Hexanone	591-78-6	**0.86**
4-Methyl-2-Pentanone	108-10-1	< 0.77
Acetone	67-64-1	**15**
Benzene	71-43-2	**2.7**
Bromodichloromethane	75-27-4	< 0.77
Bromoform	75-25-2	< 0.77
Bromomethane	74-83-9	< 0.77
Carbon Disulfide	75-15-0	< 7.7
Carbon Tetrachloride	56-23-5	< 0.77
Chlorobenzene	108-90-7	< 0.77
Chlorodibromomethane	124-48-1	< 0.77
Chlorodifluoromethane (Freon 22)	75-45-6	**1.1**
Chloroethane	75-00-3	< 0.77
Chloroform	67-66-3	**7.7**
Chloromethane	74-87-3	< 0.77
cis-1,2-Dichloroethene	156-59-2	**190 D**
cis-1,3-Dichloropropene	10061-01-5	< 0.77
Ethylbenzene	100-41-4	< 0.77
Dichlorodifluoromethane (Freon 12)	75-71-8	**2.1**
Methyl Tert-Butyl Ether	1634-04-4	< 0.77
Methylene Chloride	75-09-2	< 0.77
Styrene	100-42-5	< 0.77
Tetrachloroethene	127-18-4	**14**
Toluene	108-88-3	< 0.77
trans-1,2-Dichloroethene	156-60-5	**2.5**
trans-1,3-Dichloropropene	10061-02-6	< 0.77
Trichloroethylene	79-01-6	**320 D**
Trichlorofluoromethane (Freon 11)	75-69-4	**1.6**
Trichlorotrifluoroethane (Freon 113)	76-13-1	< 0.77
Vinyl chloride	75-01-4	< 0.77
Xylene-o	95-47-6	< 0.77
Xylenes - m,p	179601-23-1	< 1.5
TVOC[2]		**720**

Notes and abbreviations on last page.

Appendix A-1. Total Effluent Vapor Sample Analytical Results, Northrop Grumman Operable Unit 3,
Bethpage Park Soil Gas Containment System, Former Grumman Settling Ponds, Bethpage, New York. (1)

Notes and Abbreviations:

Bold	Bold data indicates that the analyte was detected at or above its reporting limit.
D	Compound detected at a secondary dilution.
CAS No.	Chemical Abstracts Service list number
µg/m^3	micrograms per cubic meter
TVOC	total volatile organic compounds
USEPA	U.S. Environmental Protection Agency
<	Compound not detected above its laboratory quantification limit.

1. Samples were collected by operation and maintenance personnel on the date shown and submitted to ALS Environmental, Simi Valley, CA for volatile organic compound analyses using USEPA Method TO-15 modified in accordance with the project Sampling and Analysis Plan (ARCADIS 2008).
2. TVOC determined by summing individual detections and rounding to the nearest whole number.

Appendix A-2. Total Effluent Vapor Sample Analytical Results, Tentatively Identified Compounds, Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System, Former Grumman Settling Ponds, Bethpage, New York.[1,2,3]

	Sample ID:	VSP-601
	Sample Date:	9/10/2014
	Units:	ppbv
Acetaldehyde		**5.3 JN**
Acetophenone		**2.7 JN**
$C_9H_{12}O$ Compound		**NA**
$C_{10}H_{20}$ + Unidentified Compound		**NA**
$C_{12}H_{24}$ Compound		**NA**
$C_{14}H_{28}$ Compound		**NA**
Dimethylnapthalene isomer		**0.87 JN**
Dimethylnapthalene isomer		**1.5 JN**
Dimethylnapthalene isomer		**1.5 JN**
Dimethylnapthalene isomer		**1.9 JN**
n-Butanal		**1.4 JN**
n-Pentadecane		**6.9 JN**
n-Pentanal		**0.89 JN**
n-Tetradecane		**1.2 JN**
Trimethylsilanol		**0.80 JN**
Unidentified Compound		**NA**
Unidentified Compound		**NA**

Notes and Abbreviations:

Bold	Bold data indicates that the analyte was detected.
JN	Compound tentatively identified, concentration is estimated.
NA	Unidentified compound detected but estimated concentration cannot be calculated.
ppbv	parts per billion by volume
USEPA	U.S. Environmental Protection Agency

1. Samples were collected by operation and maintenance personnel on the dates shown and submitted to ALS Environmental, Simi Valley, CA for volatile organic compound analyses using USEPA Method TO-15 modified in accordance with the project Sampling and Analysis Plan (ARCADIS 2008).
2. Tentatively identified compounds are identified based on review of mass spectrometry results via a comprehensive library search of all organic compounds.
3. All results are estimated.

ARCADIS

Appendix B

Summary of Air Modeling Calculations

Table B-1. Summary of SCREEN3 Model Input and Outputs, Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System, Former Grumman Settling Ponds, Bethpage, New York.

Parameters	Date Sampled:	12/4/2013	3/11/2014	6/20/2014	9/10/2014
SCREEN3 Model Input					
Source Type		Point	Point	Point	Point
Emission Rate (g/s)		1	1	1	1
Stack Height (m)		10.1	10.1	10.1	10.1
Stack Inside Diameter (m)		0.41	0.41	0.41	0.41
Air Flow Rate (scfm)(1)		720 (9)	665	734	683
Air Flow Rate (acfm @ stack temp)(2)		760	695	781	716
Stack Gas Exit Temperature (K)(1)		311	308	313	309
Ambient Air Temperature (K)(3)		277	276	294	293
Receptor Height (m)(4)		1.5	1.5	1.5	1.5
Urban/Rural		Urban	Urban	Urban	Urban
Building Height (m)		2.4	2.4	2.4	2.4
Min Horizontal Bldg Dim (m)		4.9	4.9	4.9	4.9
Max Horizontal Bldg Dim (m)		5.0	5.0	5.0	5.0
Consider Bldg Downwash?		Yes	Yes	Yes	Yes
Simple/Complex Terrain Above Stack		Simple	Simple	Simple	Simple
Simple/Complex Terrain Above Stack Base		Simple	Simple	Simple	Simple
Meteorology		Full	Full	Full	Full
Automated Distances Array		Yes	Yes	Yes	Yes
Terrain Height Above Stack Base		0	0	0	0
SCREEN3 Model Output					
1-HR Max Concentration at Receptor Height ($\mu g/m^3$)(5)		1,036	1,103	1,188	1,240
Annualization Factor(6)		0.08	0.08	0.08	0.08
Average Annual Concentration at Receptor Height ($\mu g/m^3$)(7)		82.9	88.2	95.0	99.2
Distance To Max Concentration (m)(8)		50	49	47	46

Notes and abbreviations on last page.

Table B-1. Summary of SCREEN3 Model Input and Outputs, Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System, Former Grumman Settling Ponds, Bethpage, New York.

Notes and Abbreviations:

acfm	actual cubic feet per minute
ft	feet
g/s	grams per second
°K	degrees Kelvin
m	meter
scfm	standard cubic feet per minute
$\mu g/m^3$	micrograms per cubic meter
USEPA	U.S. Environmental Protection Agency

1. The stack air flow rate (in scfm) and exit temperature were measured using a handheld thermo-anemometer. Values were measured at the stack effluent location.
2. The stack air flow rate at the stack temperature (in acfm) was calculated by dividing the stack air flow rate in scfm by the ratio of the standard temperature to the actual stack gas exit temperature.
3. The ambient temperature was recorded from the weather.newday.com website for Islip, New York. The mean actual temperature from the website was used in model calculation.
4. The receptor height corresponds to the average inhalation level.
5. SCREEN3 calculated constituent concentration at listed conditions at the specified inhalation level.
6. A USEPA time averaging conversion factor of 0.08 was used to convert the 1-hour maximum concentration output to an annual average.
7. Average annual constituent concentration at the receptor height was calculated by multiplying the one hour maximum concentration by the annualization factor.
8. SCREEN3 calculated distance to the 1-hour maximum concentration.
9. The effluent air flow rate was remeasured on December 6, 2013 due to an erroneous value recorded on December 4, 2013.

Table B-2. Summary of Maximum Allowable Stack Concentration Calculations, Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System, Former Grumman Settling Ponds, Bethpage, New York.

Compound	Actual Effluent Concentrations[(1)] (µg/m^3)			
	12/4/2013	3/11/2014	6/20/2014	9/10/2014
1,1,1-Trichloroethane	13	7.6	7.3	6.3
1,1-Dichloroethane	11	6.9	6.2	5.4
1,1-Dichloroethene	1.6	0	1.4	0.77
1-Chloro-1,1-difluoroethane (Freon 142b)	170	150	260	150
2-Hexanone	0	0	0	0.86
Acetone	0	0	7.1	15
Benzene	0	18	0	2.7
Chlorodifluoromethane (Freon 22)	3.0	2.8	1.2	1.1
Chloroform	38	8.0	9.8	7.7
cis-1,2-Dichloroethene	500	320	410	190
Dichlorodifluoromethane (Freon 12)	2.5	2.2	2.1	2.1
Tetrachloroethene	14	7.9	13	14
Toluene	0	0	0.75	0
trans-1,2-Dichloroethene	3.3	0	2.5	2.5
Trichloroethylene	570	300	390	320
Trichlorofluoromethane (Freon 11)	1.3	0	1.2	1.6
Vinyl chloride	0.92	0	0.99	0

Notes and abbreviations on last page.

Table B-2. Summary of Maximum Allowable Stack Concentration Calculations, Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System, Former Grumman Settling Ponds, Bethpage, New York.

Compound	AGC[(2)] ($\mu g/m^3$)	Annual MASC[(3)(5)] ($\mu g/m^3$)			
		12/4/2013	3/11/2014	6/20/2014	9/10/2014
1,1,1-Trichloroethane	5,000	1.7E+08	1.7E+08	1.4E+08	1.5E+08
1,1-Dichloroethane	0.63	2.1E+04	2.2E+04	1.8E+04	1.9E+04
1,1-Dichloroethene	200	6.7E+06	6.9E+06	5.7E+06	6.0E+06
1-Chloro-1,1-difluoroethane (Freon 142b)	50,000	1.7E+09	1.7E+09	1.4E+09	1.5E+09
2-Hexanone	30	1.0E+06	1.0E+06	8.6E+05	8.9E+05
Acetone	30,000	1.0E+09	1.0E+09	8.6E+08	8.9E+08
Benzene	0.13	4.4E+03	4.5E+03	3.7E+03	3.9E+03
Chlorodifluoromethane (Freon 22)	50,000	1.7E+09	1.7E+09	1.4E+09	1.5E+09
Chloroform	14.7	4.9E+05	5.1E+05	4.2E+05	4.4E+05
cis-1,2-Dichloroethene	63	2.1E+06	2.2E+06	1.8E+06	1.9E+06
Dichlorodifluoromethane (Freon 12)	12,000	4.0E+08	4.1E+08	3.4E+08	3.6E+08
Tetrachloroethene	4.0	1.3E+05	1.4E+05	1.1E+05	1.2E+05
Toluene	5,000	1.7E+08	1.7E+08	1.4E+08	1.5E+08
trans-1,2-Dichloroethene	63	2.1E+06	2.2E+06	1.8E+06	1.9E+06
Trichloroethylene	0.2	6.7E+03	6.9E+03	5.7E+03	6.0E+03
Trichlorofluoromethane (Freon 11)	5,000	1.7E+08	1.7E+08	1.4E+08	1.5E+08
Vinyl chloride	0.068	2.3E+03	2.4E+03	1.9E+03	2.0E+03

Notes and abbreviations on last page.

Table B-2. Summary of Maximum Allowable Stack Concentration Calculations, Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System, Former Grumman Settling Ponds, Bethpage, New York.

Compound	Percent of Annual MASC[4][5]			
	12/4/2013	3/11/2014	6/20/2014	9/10/2014
1,1,1-Trichloroethane	0.0%	0.0%	0.0%	0.0%
1,1-Dichloroethane	0.052%	0.032%	0.034%	0.029%
1,1-Dichloroethene	0.0%	0.0%	0.0%	0.0%
1-Chloro-1,1-difluoroethane (Freon 142b)	0.0%	0.0%	0.0%	0.0%
2-Hexanone	0.0%	0.0%	0.0%	0.0%
Acetone	0.0%	0.0%	0.0%	0.0%
Benzene	0.0%	0.40%	0.0%	0.070%
Chlorodifluoromethane (Freon 22)	0.0%	0.0%	0.0%	0.0%
Chloroform	0.0077%	0.0016%	0.0023%	0.0018%
cis-1,2-Dichloroethene	0.024%	0.015%	0.023%	0.010%
Dichlorodifluoromethane (Freon 12)	0.0%	0.0%	0.0%	0.0%
Tetrachloroethene	0.010%	0.006%	0.011%	0.012%
Toluene	0.0%	0.0%	0.0%	0.0%
trans-1,2-Dichloroethene	0.0%	0.0%	0.0%	0.0%
Trichloroethylene	8.5%	4.3%	6.8%	5.4%
Trichlorofluoromethane (Freon 11)	0.0%	0.0%	0.0%	0.0%
Vinyl chloride	0.040%	0.0%	0.051%	0.0%

Notes and abbreviations on last page.

Table B-2. Summary of Maximum Allowable Stack Concentration Calculations, Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System, Former Grumman Settling Ponds, Bethpage, New York.

Notes and Abbreviations:

AGC	Allowable Annual Guideline Concentration
DAR-1	Division of Air Resources Air Guide-1
MASC	Maximum Allowable Stack Concentration
$\mu g/m^3$	micrograms per cubic meter
NYSDEC	New York State Department of Environmental Conservation
SGC	Short-term Guideline Concentration
%	percent

1. Actual effluent concentrations are analytical results from air samples collected on the dates shown. Data in this table corresponds to the past year of system operation. Table summarizes detected compounds only.

2. AGC refers to the compound-specific AGC per the NYSDEC DAR-1 AGC/SGC tables, revised February 28, 2014.

3. Annual MASC was calculated by dividing the product of the AGC of a compound and the ratio of the SCREEN3 gas emission rate and the SCREEN 3 average annual concentration at receptor height by the air flow rate at the stack temperature and multiplying by the appropriate conversion factors.

4. Percent of MASC was calculated by dividing the actual effluent concentration by the MASC for a given monitoring event.

5. Annual MASC and % MASC for the effluent vapor samples collected on December 4, 2013 and March 11, 2014 have been recalculated as of the 2nd quarter in 2014, due to revisions to the NYSDEC DAR-1 AGC/SGC tables as of February 28, 2014. Values reported in previous quarterly reports may vary due to the revised limits.